

SUMMARY OF A WORKER REENTRY
SAFETY STUDY OF PHOSALONE (ZOLONE)
ON CITRUS - SEPT.-OCT. 1974

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BY

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On October 3, 1973, the Department of Food and Agriculture completed a worker reentry safety study in a citrus grove that had received, in 3 applications during the summer, a total load of 18 pounds per acre of a pesticide called phosalone (Zolone). The last application occurred 14 days before workers entered. The final application was at a rate of 6 pounds per acre. During this study workers were exposed to a maximum leaf load of 112 ppm of dislodgable phosalone and 17 ppm of dislodgable phosalone oxone. Inside these leaves there was an average of 75 ppm of penetrated phosalone. The study site was in Woodlake, California in Tulare County on the east side of the San Joaquin Valley of central California.

A group of 14 adult males with ages ranging from 19 to 72 years participated as citrus tree pruners in this final part of the study. A separate group of 4 adult males acted as controls. Two weeks before entering the field the workers were selected and informed thoroughly of the nature of the study. One week before the study, beginning on September 16, the workers were given physical examinations, and a series of two cholinesterase tests each. Also during this week they pruned citrus and olive trees that had no pesticide residue on them.

For the purpose of the study, the third application of phosalone to the citrus grove was split into two parts: twelve rows were sprayed on September 3 and then thirteen days later, on September 16, the remaining 24 rows were sprayed.

The workers began working on September 24 by pruning for three consecutive days in the twelve-row phosalone-treated plot that had been sprayed 21 days before. This exposure was then followed on October 30 with entry to the plot that had been sprayed 14 days before.

The pruning activity was for removing internal dead wood and this resulted in very substantial body contact of the workers with foliage, probably more than occurs with picking citrus. Each day the workers were in the grove the sun shone all day and the maximum air temperature for the day exceeded 88° F. In this exposure period, three blood samples were collected at the end of each day from each worker and these were analyzed at three different laboratories by three different techniques: the pH stat, the Ellman, and a gas chromatographic technique. A one-way analysis of variance was performed on the cholinesterase values. If the variance ratio, F, exceeded tabular values at the 5 percent level, Duncan's multiple range test was performed on group means. The variance ratio, F, determined from the cholinesterase

activity of 4 control men (Ellman method for plasma and red cell cholinesterase) was less than tabular values at 5 percent level. Similar results were obtained for plasma from the 14 citrus tree pruners. An F value slightly larger than the tabular F (6.23 vs. 2.03) was obtained for their red blood cells. Duncan's multiple range test indicated that the mean red blood cell value from the 14 tree pruners was significantly different on October 1, 1974 (the second day of 14 day reentry study) from bloods drawn prior to and after this day. The exposure mean for this day (average cholinesterase value) was 15 percent below the pre-exposure mean, while the control mean for October 1, 1974 was only 6 percent below the pre-exposure control mean. The October 1, 1974 red cell mean for the tree pruners was not significantly different from the September 18, 1974, pre-exposure mean according to the pH stat method. In summary, the blood cholinesterase activity (plasma and red cell) of 14 citrus pruners exposed to high residues of Zolone-Zolozone remained at or near pre-exposure levels during the six days in the orchard. No progressive reduction in plasma or red cell cholinesterase activity was noted. No adverse health effects were noted. However, three cases of dermatitis were observed by the supervising physician at the end of the second day of working in the plot that had been treated 21 days before. One week later, after workers had been in the plot for one day, the cases of dermatitis disappeared and no new cases were observed.

Based upon the combined toxic potential of phosalone and phosalone oxone, it appears that a 14-day safety interval can be set for workers exposed to this amount of toxic potential of phosalone and phosalone oxone. This application rate and consequent residue load far exceeds anticipated new label recommendations for citrus, stones fruits, and grapes. It would appear quite safe to set a 14-day safety interval for all three crops. From a careful analysis of crops it would appear that even somewhat shorter intervals might be set for these three crops. Any intervals shorter than 14 days would need to be based upon specific maximum application rates and possible restrictions on serial or simultaneous combinations of phosalone with other organophosphates such as ethion and azinophosmethyl (Guthion).

This cooperative study involved overall planning by Dr. Michael Gallo and on site planning and supervision of field activities by Dr. Donald Lillie; both are with Rhodia Chemical Company. Dr. James Knaak, Staff Toxicologist of our Department, was in charge of coordination of all laboratory activities for residue and blood analysis as well as the interplay of this work with the study in general. Dr. Frank Clarke, a physician in general practice in Woodlake, provided the medical supervision. His participation had been recommended by the Tulare County Medical Society. Dr. Ephraim Kahn of the State Health Department provided medical consultation to Dr. Clark. Agricultural Inspectors Kimber Hentschel and Lori Peterson of our Department, collected leaf residue samples and served as field observers of the work activities. Mr. Jerry Alexander of our Department served as the residue chemist and Mr. Terry Jackson of our Department conducted the gas chromatographic studies on the blood. Mr. Gerald Carlson of Carlson Medical Laboratories of Fresno conducted the Ellman blood tests and the Mineral King Laboratory at Visalia conducted the pH stat tests.

Ms. Linda Scott served as the observer for the State Health Department throughout the study. Others from the State Health Department who visited

the project or carried on other studies on the site included Drs. Ephraim Kahn, William Serat, and Richard Lynnes as well as Mr. Donald Mengle and Mr. Arcadio Viveros. Mr. Ronald Montgomery from the Fresno County Health Department and Dr. Jake MacKenzie from the U.S. Environmental Protection Agency also visited the project.

Based upon information gained in this study, this Department in cooperation with the State Health Department hopes to release a protocol to serve as a guide to pesticide manufacturers for similar worker safety studies so that upon their completion there will be adequate data available to set worker safety intervals where needed.